PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
92558-12009LA		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/HU00/00073	03/07/2000	15/07/1999
International Patent Classification (IPC) or national classification and IPC H02J7/00		
Applicant FAZAKAS, Andras		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 5 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
08/02/2001	08.11.2001
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Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/HU00/00073

I. Basis of th rep rt

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

4-11	as originally filed			
1,2	as received on	12/10/2001	with letter of	12/10/2001

Claims, No.:

1-8	as received on	12/10/2001	with letter of	12/10/2001

Drawings, sheets:

1/4-4/4	as originally filed

Sequence listing part of the description, pages:

4-11, as originally filed

1,2, filed with the letter of 12.10.2001

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☒ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence

listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:
   ☐ the claims, Nos.:
   ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-8
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-8
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-8
	No:	Claims	

2. Citations and explanations
   see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
se separate sheet

Re It m V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. After analysis of the amended claim 1, document D3 (US4820965) becomes the best prior art.

D3 describes a central control unit for controlling the charging process of a battery, comprising:

- a charger circuit coupled to the battery;
- a circuit for conditionally prohibiting said charging process when predetermined conditions are met, said conditions comprising at least the condition of:
- $T_B > T_{max}$, where T_B designates the actual temperature of the battery and T_{MAX} designates the highest permissible battery temperature,
- and if the battery voltage U_B lies below a predetermined threshold value U_O
- and if the charging current I_{CH} exceeds a predetermined maximum value I_{MAX}
- and an end-of-charge condition.

The subject-matter of claim 1 differs in that:

- said end-of-charge condition is generated when the change of one of the battery current and voltage dI and dU decreases within a predetermined time period below a predetermined threshold level;
- said prohibiting circuit comprising conditional and protection circuits, said protection circuits being associated with two of said predetermined conditions, of which the first takes place when the battery voltage lies below a predetermined threshold and the second takes place when the charging current exceeds a predetermined maximum value;
- the control unit further comprises furthermore a restart circuit for restarting the conditionally prohibited charging process, said restart circuit comprising a plurality of inputs (1 to 4) through which respective restart signals can be received, wherein a common precondition for any restart operation lies in that the temperature of the battery (T_B) is lower than an acceptable predetermined temperature (T_{OK}), said restart conditions being associated with the same parameters as those constituting said conditional prohibitions, however, the actual values of the restart condition lying by respective predetermined hysteresis below the values of the associated conditional prohibition parameters.

These features allow a fast charging, where a big number of battery parameters are controlled and also a restart of the charging is possible when these parameters take new values.
The subject-matter of claim 1 is therefore novel (Article 33(2) PCT).

2. Claims 2 to 8 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

Re Item VII

Certain defects in the international application

1. Taking into account the amended pages 1,2 with the applicant letter of 12.10.2001, the lines 1-11 of page 4 should have been deleted.

Re Item VIII

Certain observations on the international application

1. In the characterising part of claim 1, the feature related to the final prohibition circuit is not supported by the description, where is said that the control unit comprises protection or stop circuits associated with the battery temperature and the charging current, conditions mentioned in the preamble of claim 1.(Article 6 PCT).

2. The term " an acceptable predetermined temperature" used in claim 1 is vague and unclear and leaves the reader in doubt as to the meaning of the technical features to which it refers, thereby rendering the definition of the subject-matter of said claim/s unclear (Article 6 PCT).
According to the description, on page 8, this temperature represent a temperature at which the battery is capable of restarting charging.

3. In claim 3 the final stop circuit is not defined previously.

Central control unit for controlling the charging process of a battery

The invention relates to a central control unit for controlling the charging process of a battery, that examines the existence of the conditions required for the charging, and in accordance with the result of the examination it enables or prohibits the charging process, and in given cases it might change the power of the charging.

The central control unit according to the invention is thus not the charger circuit but an independent unit that controls the charging which is a different complex process itself.

In charging batteries and especially if batteries of larger capacity are charged, the effect that the charging process imposes on the battery has an increased significance. If during the charging process the voltage, current, temperature or the time of the charging exceeds certain limit values, than it will result in damages in either the battery or in the charging circuit or the battery cannot be charged till the maximum of its capacity or its cycle life time decreases.

Most of the practically used charger circuits comprise a unit that performs certain control function, that prevents the battery voltage during the charging process from exceeding a predetermined limit value. The designs capable of monitoring one or two parameters have simple circuitry but they cannot provide optimum conditions for the battery because the number of parameters that require inspection is much higher than actually monitored.

A limited multi-function condition system is monitored e.g. by the integrated circuit MC 33340P described in the Master Selection Guide publication SG 73/D Rev. 17, 1998 of Motorola Inc. This circuit monitors the decrease of the battery voltage, and the temperature and voltage of the battery. This charging circuit cannot be regarded sufficiently complex to be able to provide optimum conditions for the charging of the battery and for the user.

European patent publication EP 0 760 532 A1 describes a charging method for a secondary battery, by which the battery is prevented from being charged when its temperature is outside of a permitted range. The system does not deal with the

optimization of the charging time and does not monitor a number of parameters which might cause harm to the battery when being outside of a permitted range.

U.S. patent 5,635,820 describes a battery charging control device which is intended primarily to lead acid batteries used generally in vehicles. This system functions according to a pre-selected charging method. There are respective algorythms associated with each charging methods that take into account the battery temperature and a predetermined end-of-charge condition. Charging is permitted only if the battery is in the permitted temperature range and the end-of-charge condition has not yet been reached. There are, however, numerous other parameters that should be monitored and should be taken into account when an optimized charging should be provided for a wide range of battery types.

The provision of appropriate conditions will have the higher significance the more one wishes to provide optimum conditions for the battery, whereas the claim for optimization covers the fulfillment of the request of the users, which includes primarily the decreasing of the charging time. With other words the battery should be charged in the possible shortest time to reach its maximum capacity, and the charging process should at the same time occur under optimum conditions for the battery. This task has left so far unsolved even if given size capacity and type of batteries by conventional charging circuits. The solution of this task appears to be impossible if it is expected from the control unit to satisfy the above complex range of requirements in case of batteries with different types, sizes and designs that require different charging conditions. The most difficult is the simultaneous monitoring of the temperature, the electrical limit values of the charging and of the end of charge moment, and to provide an immediate and appropriate intervention if it is needed.

The object of the invention is to provide a central control unit for controlling the charge of a battery that has an universal use, and which is capable of providing optimum conditions both for the battery and the user during the charging process.

According to the invention the objects have been attained by a central control unit structured according to the attached claims.

Claims:

1. Central control unit for controlling the charging process of a battery, comprising:

- a charger circuit coupled to the battery;

- a circuit for prohibiting said charging process when predetermined conditions are met, said conditions comprise at least the condition of :

- $T_B > T_{max}$, where T_B designates the actual temperature of the battery and T_{max} designates the highest permissible battery temperature,

- and if the battery voltage U_B lies below a predetermined threshold value U_o

- and if the charging current I_{ch} exceeds a predetermined maximum value I_{max}

- and an end-of-charge condition,

characterized in that said end-of-charge condition is generated when the change of one of the battery current and voltage dI and dU decreases within a predetermined time period below a predetermined threshold level; said prohibiting circuit comprises respective conditional and final prohibition circuits, wherein said final prohibition circuit is associated with two of said conditions of which the first one takes place when the battery voltage U_B lies below a predetermined threshold value U_o and the second condition takes place when the charging current I_{ch} exceeds a predetermined maximum value I_{max}; said conditional prohibition circuit is associated with every other one of said prohibition conditions, said central control circuit comprises furthermore a restart circuit for restarting the conditionally prohibited charging process, said restart circuit comprises a plurality of inputs (1 to 4) through which respective restart signals can be received, wherein a common precondition for any restart operation lies in that the temperature of the battery (T_B) is lower than an acceptable predetermined temperature (T_{ok}), said restart conditions are associated with the same parameters as those constituting said conditional prohibitions, however, the actual values of the restart condition

lying by respective predetermined hystereses below the values of the associated conditional prohibition parameters.

2. The control unit as claimed in claim 1, further comprising a comparator circuit (K) monitoring the inequality $U_B<U_o$, and having an output coupled to a control line (L1), and a semiconductor switch (T1) controlling the operation of said charger and having a control electrode connected to said control line (L1) for disconnecting the charging process if said inequality becomes true.

3. The control unit as claimed in claim 1, wherein said final stop circuit comprising a thyristor (Th1) having a control electrode connected to an input (12) receiving the final stop condition signal, and said final stop circuit is broken upon removal of the battery only.

4. The control unit as claimed in claim 1, wherein said conditional prohibition circuit comprises thyristors (Th2 to Th5) each associated with a respective one of said conditions, and the control electrodes of said thyristors being connected to prohibition inputs (6 to 11) receiving signals of said conditions, and the main circuits of said thyristors being coupled to the control input of a switch (R1) controlling the charging circuit (CH) to disable the same when being activated.

5. The control unit as claimed in claim 4, wherein the main circuits of said thyristors (Th2 to Th5) in the conditional prohibition circuit are connected in series with said restart circuit that comprises a pair of transistors (T4, T5) connected in series, one being controlled by the condition $T_B < T_{ok}$, and the other one in the pair being controlled through an OR gate by all other conditional restart inputs (1 to 4).

6. The control unit as claimed in claim 1, further comprising switches (S3), and a further thyristor (Th6), wherein the respective stop inputs of said conditional

prohibition circuit being connected through said switches (S3) to the control electrode of this further thyristor (Th6), said charger circuit (CH) having a mode selector input adjusting a second charging mode with decreased charging power, and the further thyristor (Th6) when being set into conductive state enabling said second charging mode, and this conductive state being maintained till the end of the battery charging process.

7. The control unit as claimed in claim 1, comprising a manually operated switch (S1) allowing the commencement of the charging process in spite of an existing final prohibition command generated because of the low level of the battery voltage to enable manual starting, whereby the low battery voltage is allowed to increase above the threshold value U_o.

8. The control unit as claimed in claim 1, comprising a charge power controller (SK) connected to said charging circuit (CH) for to supply alternating power thereto with variable flowing angle, wherein in said prohibition modes said charge power controller (SK) being controlled to continuously decrease the flowing angl , and in said charging mode the flowing angle is continuously increased.